

DESCRIPTION

Title of Invention

ROOFING MATERIAL AND ROOF STRUCTURE

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Technical Field

[0001]

The present invention relates to a roofing material for formation of a roof of a building such as a house and a factory and a roof structure constituted by the roofing materials.

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Background Art

[0002]

A roof of a building such as a house and a factory can be formed by installing a plurality of roofing materials each having a substantially rectangular shape on a roof base in a vertical direction and in a lateral direction sequentially. In a case of a roof having such a roof structure, respective sides of the two roofing materials adjacent to each other in a lateral direction of the roof, i.e. in a direction perpendicular to an inclining direction of the roof are overlapped each other (e.g. see document 1 [JP 08-277606 A]). FIG. 11 shows a partial cross-sectional view of one example of the above type of roof structure. Each of roofing materials 100 for this roof structure includes a cover part 40 having a substantially flat plate shape formed at one of opposite ends thereof and a water barrier part 41 having a wave shape in a sectional view formed at the other end thereof. The water barrier part 41 includes a plurality of protrusions 41a. The adjacent two roofing materials 100 are installed on a roof base 6 such that the water barrier part 41 of one of the adjacent two roofing materials 100 is covered by the cover part 40 of the other one of the adjacent two roofing materials 100. The adjacent two roofing materials 100 are installed under a condition that respective sides thereof are overlapped each other and thereby the above roof structure can improve a water barrier property of the roof and also has a water barrier function owing to the plurality of protrusions 41a formed on the water barrier part 41.

[0003]

In a case where the respective sides of the two roofing materials are overlapped as mentioned above, when a lateral overlap between the sides is too small, rainwater may arrive at the roof base through the overlap and thus a water barrier property of the roof is likely to be insufficient. In contrast, when the lateral overlap between the sides is too long, the number of roofing materials 100 to be used is likely to increase, and therefore workability and appearance of the roof are likely to deteriorate. In view of this, in a process of overlapping the two roofing materials 100 and 100, it is necessary to adjust the length of the lateral overlap to a predetermined length. As a result, such adjustment of the length of the overlap may take troubles and time, and therefore workability may be insufficient. Further, precision of the adjustment of the length of the overlap may also strongly depend on a worker's experience, and thus precision of the installation may be unstable.

Summary of Invention

[0004]

In view of the above insufficiency, the present invention has aimed to propose a roofing material enabling easy and precise adjustment of a dimension of an overlap and having improved workability, and a roof structure including the roofing materials.

[0005]

The roofing material in accordance with the present invention is configured to be connected with a further roofing material under a condition that respective sides of the roofing material and the further roofing material are overlapped with each other, the roofing material including: a main body having a substantially flat plate shape; and a fitting part formed at an end of the main body, the roofing material further including at least one positioning marker which is provided to the fitting part so as to indicate a position of an overlap between the respective sides.

[0006]

In a preferred aspect of the roofing material, the at least one positioning marker is formed by partially cutting out the fitting part.

[0007]

In a preferred aspect of the roofing material, the roofing material includes, as the at least one positioning marker provided to the fitting part, two positioning markers

which are a first positioning marker and a second positioning marker, the first positioning marker and the second positioning marker being formed such that a distance of the first positioning marker from one of opposite side ends of the fitting part is substantially equal to a distance of the second positioning marker from the other of the opposite side ends of the fitting part.

[0008]

The roof structure in accordance with the present invention includes two or more roofing materials as described above, adjacent two roofing materials of the two or more roofing materials being connected under a condition that respective sides of the adjacent two roofing materials are overlapped with each other so that one side end of the fitting part of one of the adjacent two roofing materials conceals the at least one positioning marker of the other of the adjacent two roofing materials.

[0009]

The roofing material in accordance with the present invention includes the at least one positioning marker which serves as a reference position of an overlap between the respective sides of the roofing material and the further roofing material which are adjacent to each other. Therefore, when the roofing material and the further roofing material are connected, it is possible to easily and precisely adjust the dimension of the overlap between the roofing material and the further roofing material. Thereby, it is possible to easily connect the roofing material and the further roofing material and improve precision of the connection, and also it becomes easy to form a roof having a high water barrier property (waterproof property).

[0010]

Further, the roof structure in accordance with the present invention is formed by connecting the above roofing materials. Therefore, the roof structure can be formed easily and has a high water barrier property.

Brief Description of Drawings

[0011]

FIG. 1A is a perspective view illustrating an example of the roofing material according to the embodiment of the present invention.

FIG. 1B is a plan view illustrating the example of the roofing material according to the embodiment of the present invention.

FIG. 2A is a side view illustrating the example of the roofing material according to the embodiment of the present invention.

FIG. 2B is a sectional view illustrating a side end of the example of the roofing material according to the embodiment of the present invention.

5 FIG. 3A is a partial perspective view illustrating the example of the roofing material according to the embodiment of the present invention.

FIG. 3B is a partial perspective view illustrating a further example of the roofing material according to the embodiment of the present invention.

10 FIG. 4A is a partial plan view illustrating the example of the roofing material according to the embodiment of the present invention.

FIG. 4B is a partial plan view illustrating the example of the roofing material according to the embodiment of the present invention.

FIG. 5A is a partial plan view illustrating the further example of the roofing material according to the embodiment of the present invention.

15 FIG. 5B is a partial plan view illustrating the further example of the roofing material according to the embodiment of the present invention.

FIG. 6A relates to explanation about installation of the roofing material according to the present invention, and shows a partial perspective view explaining about how to connect the adjacent roofing materials to each other.

20 FIG. 6B relates to explanation about installation of the roofing material according to the present invention, and shows a partial perspective view illustrating the structure in which the adjacent roofing materials are connected to each other.

FIG. 7A is a partial plan view for explanation about installation of the above roofing material.

25 FIG. 7B is a partial plan view for explanation about the installation of the above roofing material.

FIG. 8 relates to explanation about installation of the roofing material according to the present invention, and shows a sectional view illustrating the structure in which the adjacent roofing materials are connected to each other.

30 FIG. 9 relates to explanation about installation of the roofing material according to the present invention, and shows a sectional view illustrating connection of the roofing materials adjacent to each other.

FIGS. 10A to 10D each relate to explanation about installation of the roofing material

according to the present invention, and show a sectional view illustrating fitting of the roofing materials adjacent to each other.

FIG. 11 is a sectional view illustrating a conventional structure in which adjacent roofing materials are connected to each other.

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Description of Embodiments

[0012]

The following explanations are made to embodiments of the present invention.

[0013]

10 FIGS. 1A, 1B, 2A and 2B each show an example of the roofing material 100 of one embodiment in accordance with the present invention. FIG. 1A is a perspective view of the roofing material 100 and FIG. 1B is a plan view of the roofing material 100. In the figures, a central portion of the roofing material 100 is partially omitted. FIG. 2A is a side view of the roofing material 100 and FIG. 2B is a partial sectional view of a side end of the roofing material 100. The following explanations referring to FIGS. 1A, 1B, 2A and 2B are made to the roofing material 100 of the present embodiment.

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[0014]

As shown in FIG. 1, the roofing material 100 of the present embodiment includes a main body 1, two fitting parts 4 and 5, two inclined pieces 2 and two positioning markers 3. The main body 1 is formed into a substantially flat plate shape. In the present embodiment, the main body 1 is substantially rectangular and has long sides and short sides. The two fitting parts 4 and 5 are individually situated at the long sides of the main body 1. Hereinafter, as necessary, the fitting part 4 and the fitting part 5 are referred to as "first fitting part 4" and "second fitting part 5", respectively.

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25 Further, as shown in FIGS. 1A, 1B and 2A, the two inclined pieces 2 are individually situated at the short sides of the main body 1. Note that FIG. 2A is a side view of the roofing material when viewed from the short side (inclined piece 2) of the main body 1.

[0015]

The first fitting part 4 is formed by bending an end part extending from the long side of the main body 1 towards the rear side of the main body 1 (see FIG. 2A). The first fitting part 4 is formed to extend the almost entire length of the lengthwise direction of the main body 1.

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[0016]

The second fitting part 5 is constituted by an upper piece 5a, a lower piece 5b and a fixed piece 10. As shown in FIG. 2A, the lower piece 5b is formed by bending an end part extending from the end of the main body 1 towards the front surface of the main body 1 so as to be substantially flat and extend the almost entire length in the lengthwise direction of the main body 1. The upper piece 5a protrudes from an end of the lower piece 5b away from the main body 1. The upper piece 5a is also substantially flat. The second fitting part 5 includes the upper piece 5a and the lower piece 5b as mentioned above, and thus the second fitting part 5 protrudes in a direction in which the front surface of the main body 1 is directed. In the present embodiment, the upper piece 5a does not extend close to the both ends of the lower piece 5b. In summary, the upper piece 5a does not extend the entire length of the lower piece 5b and is shorter in entire length than the lower piece 5b.

[0017]

As shown in FIG. 2A, the fixed piece 10 protrudes from an end of the upper piece 5a away from the roofing material 100 and is formed so as to extend the entire length of the upper piece 5a. In the roofing material 100 of the present embodiment, the fixed piece 10c includes an inclined part 10a and a fixed part 10b, and is formed into a substantially L shape. The inclined part 10a is formed so as to extend from an end of the upper piece 5a and be inclined downward (i.e. towards the rear side of the roofing material 100). Further, the fixed piece 10 is bent at the end of the inclined part 10a so that the fixed part 10b is substantially parallel to the main body 1. The fixed part 10b is positioned at a different level from the main body 1, and is positioned above the main body 1. As shown in FIGS. 2A and 2B, the long side of the fixed part 10b is bent towards the front surface, and as a result, the end part of the fixed part 10b is double-folded. The positioning marker 3 may be formed in the fixed piece 10. In the roofing material 100 of the present embodiment, the long side of the fixed part 10b is partially cut out to leave a cut-out and the cut-out serves as the positioning marker 3. The positioning marker 3 may be formed into various shapes such as a rectangular shape (U shape), a triangular shape (V shape), a linear shape and a circular shape in a plan view (when viewed from above).

[0018]

FIG. 3A shows an example in which the positioning marker 3 is formed into a rectangular cut-out. There is a double-folded part 10c which defines the long side of

the fixed piece 10 and extends the entire length of the fixed piece 10. The double-folded part 10c is formed by bending a metal plate at 180 degrees (i.e., hemming). The positioning marker 3 penetrates the double-folded part 10c in a thickness direction. In a plan view, the positioning marker 3 has a periphery constituted by a long side 3a parallel to the long side of the fixed piece 10 and two short sides 3b perpendicular to the long side 3a. The positioning marker 3 is opened at the long side of the fixed piece 10.

[0019]

FIG. 3B shows another case in which the positioning marker 3 is formed into a triangular cut-out. As in the above case, the double-folded part 10c defines the long side of the fixed piece 10 and extends the entire length of the fixed piece 10. The positioning marker 3 penetrates the double-folded part 10c in a thickness direction. The positioning marker 3 has a periphery constituted by two inclined sides 3c inclined with respect to the lengthwise direction of the fixed piece 10. The positioning marker 3 is opened at the long side of the fixed piece 10.

[0020]

Two or more positioning markers 3 may be formed. As shown in FIGS. 1A and 1B, in the present embodiment, two positioning markers 3 and 3 are formed. Hereinafter, one of the two positioning markers 3 and 3 is referred to as a first positioning marker 31 and the other is referred to as a second positioning marker 32.

[0021]

In the roofing material 100 of the present embodiment, the positioning marker 3 is formed by cutting, but may be formed by a different method. For example, the positioning marker 3 may be a marking formed on a predetermined part of the roofing material 100 with ink, paint or the like. However, as mentioned below, in view of productivity, it is preferable that the positioning marker 3 be formed by cutting.

[0022]

In a case where the positioning marker 3 is formed into a rectangular cut-out as in the case of the roofing material 100 shown in FIGS. 1A and 1B, the width (distance between opposite short sides 3b) D1 may be approximately 6 mm, but not limited thereto. In a case where the positioning marker 3 is formed into a triangular cut-out, the width (size of opening part of the positioning marker 3) D1 may be approximately 6 mm, but not limited thereto.

[0023]

In a plan view, in a case where a dimension of an overlap of the adjacent roofing materials 100 is 100 mm, the distance D2 between the positioning marker 3 and a side end (short side) 101 of the fixed piece 10 may be 56 mm to 66 mm. Further, in a plan view, the distance D3 between the positioning marker 3 and a side end (short side) 102 of the second fitting part 5 may be 76 mm to 86 mm. When the positioning marker 3 is a rectangular cut-out, the distance D2 is defined as the distance between the side end (short side) 101 of the fixed piece 10 and the short side 3b of the positioning marker 3 which is one of the short sides closer to the center of the roofing material 100 in the lengthwise direction than the other. When the positioning marker 3 is a rectangular cut-out, the distance D3 is defined as the distance between the side end 102 of the second fitting part 5 and the short side 3b of the positioning marker 3 which is one of the short sides 3b closer to the center of the roofing material 100 in the lengthwise direction than the other. When the positioning marker 3 is a triangular cut-out, the distance D2 is defined as the distance between the side end 101 of the fixed piece 10 and a vertex (point where the two inclined sides 3c meet) 3d of the positioning marker 3. When the positioning marker 3 is a triangular cut-out, the distance D3 is defined as the distance between the side end 102 of the second fitting part 5 and the vertex (point where the two inclined sides 3c meet) 3d of the positioning marker 3. Each inclined piece 2 is formed to extend the substantially entire length of the short side of the main body 1. As shown in FIGS. 2A and 2B, each inclined piece 2 is an end part which extends from the end of the main body 1 and is bent so as to be inclined downward. Note that FIG. 2B is a sectional view of the side end of the roofing material 100 in the lengthwise direction of the roofing material 100.

[0024]

The inclined piece 2 includes sections individually defining a front part 2b, a middle part 2c and a rear part 2d. In detail, the front part 2b is defined as a section of the inclined pieces 2 which is closest to the first fitting part 4 and the rear part 2d is defined as another section of the inclined pieces 2 which is closest to the second fitting part 5. The middle part 2c is defined as a section between the front part 2b and the rear part 2d.

[0025]

The angle (minor angle here) between the main body 1 and each inclined piece 2 may be 120 degree to 150 degree, for example. In more detail, the angle between the middle part 2c and the main body 1 may be approximately 120 degree, the angle between the rear part 2d and the main body 1 may be approximately 140 degree, and the angle between the front part 2b and the main body 1 may be approximately 140 degree. In this case, the middle part 2c is greater in bend height H, which is described later, than the front part 2b and the rear part 2d.

[0026]

The front part 2b is formed such that the bend height H becomes greater towards an end close to the middle part 2c than at an end far from the middle part 2c. Note that, as shown in FIG. 2B, the bend height H is defined as the distance between the plane of the main body 1 and the imaginary plane which includes the end (referred to as "inclined piece end 2a" hereinafter) of the inclined pieces 2 and is parallel to the main body 1. The middle part 2c is formed so that the bend height H is kept substantially constant over the entire length of the middle part 2c. In other words, a part of a side end 1a connected to the section defining the middle part 2c is formed so as to be substantially parallel to the inclined piece end 2a. Further, the rear part 2d is formed such that the bend height H becomes greater towards an end close to the middle part 2c than at an end far from the middle part 2c.

[0027]

The inclined piece end 2a of the section defining the front part 2b may be linear or curved. In contrast, it is preferable that the inclined piece end 2a of the section defining the middle part 2c is formed to be linear. Further, the inclined piece end 2a of the section defining the rear part 2d may be linear or curved as in the case of the inclined piece end 2a of the section defining the front part 2b. In a case where the inclined piece end 2a of the section defining the rear part 2d is linear, the inclined piece end 2a may be bent at the substantially middle point of the inclined piece end 2a. The inclined piece ends 2a of the sections defining the front part 2b, the middle part 2c and the rear part 2d are formed in the above described manner, and thereby the inclined piece 2 protrudes downward from the roofing material 100 and curves outward. Note that the phrase "protrude downward and curve outward" means projecting (protruding) downward to have a curved outline.

[0028]

The bend height **H** of the middle part **2c** may be, for example, 3 mm to 7 mm, and may preferably be approximately 5 mm. When the inclined piece end **2a** of the front part **2b** is curved, a curvature radius thereof may be 300 mm to 500 mm, and may preferably be approximately 400 mm. Further, when the inclined piece end **2a** of the rear part **2d** is curved, a curvature radius thereof may be 1000 mm to 1500 mm, and may preferably be approximately 1200 mm. In this case, as mentioned below, it is possible to suppress formation of an interspace between parts to be overlapped of the adjacent roofing materials 100 and 100.

[0029]

The width **W** of each inclined piece **2** may be in a range of 4 mm to 9 mm over the entire length of the inclined pieces **2**, and preferably the widths **W** of the middle part **2c**, the rear part **2d** and the front part **2b** may be 6 mm, 7 mm and 7 mm, respectively. Note that, as shown in FIG. 2B, the width **W** herein is defined as the distance of the side end **1a** from the imaginary plane which includes the inclined piece end **2a** and is perpendicular to the main body **1**.

[0030]

The length of a part of the side end **1a** connected to the section defining the front part **2b** may be 40 mm to 60 mm, and preferably may be 40 mm. The length of a part of the side end **1a** connected to the section defining the middle part **2c** may be 50 mm to 100 mm, and preferably may be 60 mm. The length of a part of the side end **1a** connected to the section defining the rear part **2d** may be 80 mm to 120 mm, and preferably may be 100 mm.

[0031]

In a case where the length **L2** of the main body **1** in the width direction is 251 mm and **X1**, **X2**, **X3**, and **X4** of FIG. 2A are 20 mm, 40 mm, 60 mm, and 100 mm, respectively, the bend height **H** at a point of the front part **2b** at a distance of 40 mm from the middle part **2c** may be 3 mm, the bend height **H** at the middle part **2c** may be 6 mm and the bend height **H** at a point of the rear part **2d** at a distance of 100 mm from the middle part **2c** may be 3 mm. In this case, as described later, it is easy to prevent the formation of a gap between the inclined piece end **2a** of an upper one of the adjacent two roofing materials 100 and 100 and the main body **1** of a lower one of the adjacent two roofing materials 100 and 100.

[0032]

As shown in FIG. 2B, the inclined pieces 2 each may be provided with, as a reinforcing piece 1b, a folded-back part formed by bending the main body so that the side end is close to the rear surface. In this case, both the inclined piece 2 and the side end of the main body 1 have a double-folded structure and thereby rigidity of end parts of the roofing material 100 can be improved.

[0033]

As shown in FIG. 1, the main body 1 may be provided with at least one protrusion part 20. In the roofing material 100 of the present embodiment, the protrusion part 20 is formed to protrude in a direction in which the rear surface of the main body 1 is directed. The protrusion part 20 is formed so as to extend the substantially entire length of the main body 1 in a direction from the first fitting part 4 toward the second fitting part 5 and be substantially parallel to the short sides of the main body 1.

Further, the protrusion part 20 can be formed with, for example, a substantially U shape groove or a substantially V shape groove which opens in the front surface of the main body 1. As seen in the present embodiment, a plurality of protrusion parts 20 may be formed. In this case, the plurality of protrusion parts 20 may be formed on both side parts corresponding to the short sides of the main body 1. In the roofing material 100 shown in FIGS. 1A and 1B, the numbers of protrusion parts 20 formed on the both sides are same. As a matter of course, the numbers of protrusion parts 20 formed on the both sides may be different. The protrusion part 20 can be formed on the surface of the main body 1 by ribbing. Note that the protrusion part 20 may protrude in a direction in which the front surface of the main body 1 is directed, i.e. upward from the main body 1. Also, both of the protrusion part 20 protruding from the front surface of the main body 1 and the protrusion part 20 protruding from the rear surface of the main body 1 may be formed.

[0034]

The protrusion part 20 can be formed, for example, such that the width thereof is in a range of 4 mm to 10 mm, the depth thereof from the surface of the main body 1 is in a range of 0.5 mm to 1.5 mm, and the length thereof is 180 mm to 280 mm. Further, it is preferable that the protrusion part 20 is formed such that the distance (L3 in FIG. 1A) from the inclined piece end 2a is in a range of 100 mm to 200 mm.

[0035]

The main body 1 may include at least one position checking part 30. The position

checking part 30 is formed, for example, so as to protrude in a direction in which the front surface of the main body 1 is directed and extend the almost entire length of the main body 1 in a direction from the first fitting part 4 toward the second fitting part 5. Further, one position checking part 30 or a plurality of position checking parts 30 may be formed on each of the opposite sides of the main body 1. In either case, the position checking part 30 can be formed at the position which is 100 mm apart from the inclined piece end 2a. In a case where the plurality of position checking parts 30 are provided to each of the opposite sides of the main body 1, the plurality of position checking parts 30 can be arranged at a regular interval from the inclined piece end 2a. For example, the position checking parts 30 can be arranged at intervals of 100 mm from the inclined piece end 2a. The position checking part 30 can be formed, by ribbing or the like, for example, so as to leave a recess open to the rear surface of the main body 1. The position checking part 30 may have a substantially V shape or a substantially U shape in a sectional view.

[0036]

The length L1 of the roofing material 100 in the lengthwise direction can be set, for example, to a basic length of approximately 2000 mm, but not limited thereto. The length L2 of the roofing material 100 in the width direction can be set, for example, to 200 mm to 280 mm, and preferably can be set to approximately 250 mm.

[0037]

The roofing material 100 may be formed into a bilaterally symmetric shape. In other words, the roofing material 100 may be formed so as to be symmetry with respect to a line which divides the roofing material 100 into two left and right equal parts. Note that the left and right direction herein is a direction same as the lengthwise direction of the roofing material 100. When the roofing material 100 is formed into a bilaterally symmetric shape, as mentioned below, the roofing material 100 can be installed from either of left and right sides of the roof.

[0038]

The roofing material 100 can be formed into an intended shape by processing a metal plate by a roll forming process or the like. Examples of the metal plate include a steel sheet, a zinc-plated steel plate and a galvalume (registered trademark) steel sheet, and a front surface and a rear surface of any of the examples of the metal plate may be coated. The thickness of the metal plate may be, for example, in a range of

0.3 mm to 0.5 mm and the weight per area thereof may be, for example, in a range of 4.0 kg/m² to 5.0 kg/m².

[0039]

The roofing material 100 is generally manufactured with a roll former. However, in a case where the roofing material 100 has few parts to be subjected to an R process (curving process) as in the present embodiment, the roofing material 100 can be manufactured with a bending processor. The end of the roofing material 100 can be formed by hemming and pressing.

[0040]

In a case where the positioning marker 3 is formed by cutting, the metal plate may be subjected to cutting to form the positioning marker 3 in advance and then bent, or the metal plate may be bent and then subjected to the above cutting. In view of facilitating manufacture and being capable of continuous manufacture, it is preferable that the metal plate is subjected to cutting in advance (also referred to as pre-cutting) and then bent.

[0041]

In a case where the positioning marker 3 is constituted by a rectangular cut-out, the first step is, as shown in FIG. 4A, to make a substantially U-shaped cut 111 in an end of a metal plate 110 which is to serve as the fixed piece 10. The cut 111 is formed in an end edge 113 of the metal plate 110 so as to open outward. The next step is, as shown in FIG. 4B, to form the double-folded part 10c by bending the metal plate 110 along a bending line 114 parallel to the end edge 113 by hemming so that the end of the metal plate 110 overlaps the front surface. The bending line 114 is imaginarily set so as to pass through a point which is at a distance of the almost half of the depth of the cut 111 from the end edge 113. As a result of formation of the double-folded part 10c by almost half bending, the cut 111 is left as the positioning marker 3 constituted by the rectangular cutout.

[0042]

In a case where the positioning marker 3 is constituted by a triangular cut-out, the first step is, as shown in FIG. 5A, to make a V-shaped cut 111 in the end of the metal plate 110 which is to serve as the fixed piece 10. The cut 111 is formed in the end edge 113 of the metal plate 110 so as to open outward. The next step is, as shown in FIG. 5B, to form the double-folded part 10c by bending the metal plate 110 along the

bending line 114 parallel to the end edge 113 by hemming so that the end of the metal plate 110 overlaps the front surface. The bending line 114 is imaginarily set so as to pass through a point which is at a distance of the almost half of the depth of the cut 111 which is a length from the end edge 113 to a vertex 111a (identical with the vertex 3d of the positioning marker 3) of the cut 111. As a result of formation of the double-folded part 10c by almost half bending, the cut 111 is left as the positioning marker 3 constituted by the above triangular cutout.

[0043]

It is possible to form a roof by placing a plurality of roofing materials 100 on a sheathing roof board or the like which serves as a roof base. Placing the roofing material 100 on the roof base is also described as installing the roofing material 100. In the process of installing the roofing material 100 of the present embodiment, the first fitting part 4 is placed so as to be directed to a downward side of the inclined surface of the roof, and the second fitting part 5 is placed so as to be directed to an upward side of the inclined surface of the roof. When the roofing material 100 is installed in such a manner, the fixed piece 10 is the closest part to the upward side in the roofing material 100. The above downward side can be described as "eave side of the roof" or "downstream side of the roof". Further, the above upward side can be described as "ridge side of the roof" or "upstream side of the roof". Note that a direction interconnecting the downward side and the upward side is referred to as "inclining direction" hereinafter.

[0044]

Installation of the roofing materials 100 can be performed by preparing the plurality of roofing materials 100, and installing the plurality of roofing materials 100 sequentially from the downward side to the upward side. The adjacent roofing materials 100 in a direction perpendicular to the inclining direction on the roof base are connected to each other under a condition that the inclined piece 2 of one of the adjacent roofing materials 100 is placed on the surface of the main body 1 of the other one of the adjacent roofing materials 100.

[0045]

FIGS. 6A and 6B show a mechanism of interconnection of the roofing materials 100 and 100 adjacent to each other in the direction perpendicular to the inclining direction. FIG. 6A is a perspective view explaining about how to connect the adjacent roofing

materials to each other, and FIG. 6B is a partial perspective view illustrating the structure in which the adjacent roofing materials are connected to each other. Note that, in FIG. 6A, a lower one of the adjacent roofing materials 100 and 100 is referred to as a roofing material 100a and an upper one is referred to as a roofing material

5 100b. In the following explanations, the adjacent roofing materials 100 are described in such a manner, as necessary. In order to connect the roofing materials 100a and 100b adjacent to each other in the direction perpendicular to the inclining direction, first, the roofing material 100a is installed and next the side end of the roofing material 100b is overlapped with the side end of the preliminarily-placed roofing material 100a. In overlapping the roofing material 100a and the roofing material 100b, it is necessary to position the roofing material 100a and the roofing material 100b by adjusting an overlap dimension that is a length of an overlap between the roofing materials 100a and 100b. Such positioning may be performed with reference to the positioning marker 3. Specifically, as indicated by a dashed-dotted line in FIG. 6A, the roofing material 100a and the roofing material 100b are arranged such that the side end 101 of the fixed piece 10 of the roofing material 100b and the positioning marker 3 of the preliminarily-placed roofing material 100a are substantially on the same straight line along the inclining direction of the roof.

[0046]

20 In a case where the positioning marker 3 is constituted by a rectangular cut-out, as shown in FIG. 7A, the roofing materials 100a and 100b are positioned such that the side end 101 of the fixed piece 10 of the roofing material 100b and the side end (one short side 3b) of the positioning marker 3 of the preliminarily-placed roofing material 100a are on the same straight line along the inclining direction of the roof. In a case where the positioning marker 3 is constituted by a triangular cut-out, as shown in FIG. 7B, the roofing materials 100a and 100b are positioned such that the side end 101 of the fixed piece 10 of the roofing material 100b and the pointed vertex 3d of the positioning marker 3 of the preliminarily-placed roofing material 100a are on the same straight line along the inclining direction of the roof. In some cases, positioning with reference to the point corresponding to the pointed vertex 3d of the positioning marker 3 constituted by the triangular cut-out may be easier than positioning with reference to the line corresponding to the short side 3b of the positioning marker 3 constituted by the rectangular cut-out.

[0047]

As shown in FIG. 6A, the roofing material 100b is moved in the direction of the arrow shown in the figure such that the upper piece 5a and the lower piece 5b of the roofing material 100b are placed on the upper piece 5a and the lower piece 5b of the roofing material 100a, respectively. It is sufficient that the second fitting parts 5 of the respective roofing materials 100a and 100b are overlapped such that the second fitting part 5 of the roofing material 100a is held between the rear surfaces of the second fitting part 5 of the roofing material 100b. The roofing material 100b is placed on the roofing material 100a while the roofing material 100b is positioned as described above and, thereby, as shown in FIG. 6B, the respective sides of the roofing materials 100a and 100b are overlapped with each other and connected to each other. Further, the entire positioning marker 3 of the preliminarily-placed roofing material 100a is concealed by the fixed piece 10 of the roofing material 100b and thus cannot be seen from the front side.

[0048]

The roofing material 100 can be installed with reference to the positioning marker 3 as mentioned above and therefore it is possible to easily perform positioning for connection of the roofing materials 100a and 100b. As a result, it is possible to smoothly install the roofing materials 100 and increase precision of the installation. Further, the almost entire positioning marker 3 is concealed by the fixed piece 10 and thus is not likely to be seen from the front side, and as a result, the appearance of the roof does not become poor.

[0049]

Further, the positioning marker 3 is formed at a predetermined distance from the side end of the roofing material 100. Therefore, when the two roofing materials 100 are connected with reference to the positioning marker 3, it is possible to obtain a sufficient dimension of an overlap therebetween. Thereby, it is possible to form a roof with a high water barrier property. When the overlap is short, rainwater may reach the base such as the sheathing roof board by passing through the gap between the roofing materials 100a and 100b, and therefore leaking of rain may occur. However, by keeping a sufficient dimension of the overlap, it becomes easy to suppress intrusion of rainwater into the base. This is because, when the overlap is long, rainwater is drained out through the below described drainage space formed

between the roofing materials 100a and 100b adjacent to each other before reaching the base.

[0050]

In order to adjust the dimension of the overlap to a dimension sufficient for ensuring a water barrier property, as shown in FIGS. 6A and 6B, it is sufficient to place the side end 101 of the fixed piece 10 of the roofing material 100b and the positioning marker 3 of the preliminarily-placed roofing material 100a on the straight line as mentioned above. As a matter of course, to increase the dimension of the overlap, the side end 101 of the fixed piece 10 of the roofing material 100b may be situated closer to the center of the roofing material 100b than the positioning marker 3 is. In this case, the water barrier property (waterproof property) of the roof is further improved. The dimension of the overlap necessary for keeping a high water barrier property depends on a size and the like of the roofing materials. For example, in the case of the roofing material 100 having the configuration shown in FIGS. 1A and 1B, it is preferable that the dimension of the overlap is equal to or more than 80 mm, and it is more preferable that the dimension of the overlap is equal to or more than 100 mm. In view of workability and economic performance, it is preferable that the maximum value of the dimension of the overlap is a half of the length (L1 in FIG. 1A) of the roofing material 100 in the lengthwise direction.

[0051]

Even when the positioning marker 3 is constituted by a cut-out, the waterproof property of the roofing material 100 itself is sufficient providing that the positioning marker 3 is formed not in the main body 1, but in the end of the fixed piece 10, as the case of the roofing material 100 having the configuration shown in FIGS. 1A and 1B.

[0052]

Further, as in the case of the roofing material 100 having the configuration shown in FIGS. 1A and 1B, the roofing material 100 may include the first positioning marker 31 and the second positioning marker 32 so that the distance D3 of the first positioning marker 31 from the side end 102 of the fitting part 5 is substantially equal to the distance D3 of the second positioning marker 32 from the side end 102 of the fitting part 5. In this case, any one of the adjacent two roofing materials 100a and 100b can be placed on the other. In brief, in this case, the roofing material 100 can be installed either from the left side or from the right side. Therefore, although in

FIGS. 6A and 6B the roofing material 100a is first installed and next the roofing material 100b is installed, in contrast the roofing material 100b can be first installed, and next the roofing material 100a can be installed on the side of the front surface of the roofing material 100b. As a matter of course, also in this case, the roofing material 100a can be installed while the positioning is performed with reference to the positioning marker 3. Also, in a case where the roofing material 100 is formed into a bilaterally symmetric shape, the roofing material 100 can be installed either from the left side or from the right side as in the above case and thereby the workability can be further improved.

[0053]

FIG. 8 shows a cross-section taken along the inclining direction of the structure in which the roofing material 100a and the roofing material 100b are connected to each other. In detail, FIG. 8 is a sectional view taken along the line a-a in FIG. 6B and shows a section, taken along the side end of the roofing material 100b, of the above structure. When the two roofing materials 100 are overlapped each other as described above, the inclined piece end 2a of the upper roofing material 100b is in contact with the front surface of the main body 1 of the lower roofing material 100a over the almost entire length of the lower roofing material 100a in the lengthwise direction. Generally, when the roofing material 100 is placed on the base, the roofing material 100 is likely to warp due to the weight of the roofing material 100 or stress produced by workers walking during installation. Hence, the roofing material 100 may have a shape which curves relative to the inclining direction and protrudes in a direction in which the rear surface is directed. However, as mentioned above, the inclined piece end 2a also protrudes downward and curves outward, and therefore, as shown in FIG. 8, the inclined piece end 2a of the upper roofing material 100b fits the surface of the main body 1 of the lower roofing material 100a which curves relative to the inclining direction and protrudes in a direction in which the rear surface is directed. As a result, the inclined piece end 2a of the upper roofing material 100b and the main body 1 of the lower roofing material 100a are in close contact with each other, and it is possible to easily suppress formation of space therebetween. Thereby, it becomes easy to suppress intrusion of rainwater and the like into the overlap between the roofing materials 100 and 100 adjacent to each other in the lateral direction.

[0054]

The degree of bend of the roofing material 100 is constant, irrespective of the size of the roofing material 100. Therefore, even when the roofing material 100 is formed to have any size, the inclined piece end 2a of the roofing material 100 can fit the bend.

5 In the past, the roofing material 100 has been reinforced by use of thermal insulation material such as polyurethane and polystyrene. However, it is not necessary to reinforce the roofing material 100 of the present embodiment by bonding such thermal insulation material to the roofing material 100 or the like. Therefore, it is possible to achieve weight saving of the whole roof, facilitation of installation and cost reduction as well. Further, an unwanted space is unlikely to occur between the inclined piece end 2a of the upper roofing material 100 and the main body 1 of the lower roofing material 100 and therefore it is possible to suppress formation of shadow caused by such a space. Consequently, the whole appearance of the roof is likely to be sufficient and a roof with attractive appearance can be formed.

15 [0055]

Note that when the roofing materials 100 are overlapped each other so that the dimension of the overlap is in a range of 100 mm to a half of the length of the roofing material 100 in the lengthwise direction, inclusive, the inclined piece end 2a of the roofing material 100 can fit the bend. Further, in a case where the position checking part 30 is provided to the roofing material 100, when the roofing materials 100 adjacent in a direction perpendicular to the inclining direction are overlapped each other, it is possible to check whether the dimension of the overlap is sufficient for ensuring the water barrier property. Therefore, by forming the position checking part 30 as well as the positioning marker 3, it is possible to check the installation position of the roofing materials 100 based on double criteria. In detail, the inclined piece end 2a at the end in the lengthwise direction of the roofing material 100 is subjected to three-dimensional curving process with regard to the width direction, and thus has a curved outline. Particularly, the middle part 2c is larger in a bending angle than the front part 2b and the rear part 2d, and thus is shorter in the lengthwise direction of the roofing material 100 by about 1 to 2 mm than the front part 2b and the rear part 2d. Therefore, when the positioning is done by placing the end of the front part 2b or the end of the rear part 2d on the position checking part 30, the end of the middle part 2c is slightly displaced from the position checking part 30.

In the circumstances, it is difficult to completely perform easy and precise determination of the installation position of the roofing materials 100 with reference to only the position checking part 30 in the process of installation. The roofing material 100 of the present embodiment is excellent in that it is possible to perform
5 easy and precise determination of the installation position of the roofing materials 100 with reference to both the positioning marker 3 and the position checking part 30.
[0056]

As shown in FIG. 9, when the roofing materials 100 adjacent in the direction perpendicular to the inclining direction are overlapped with each other, there is a
10 space S formed between the roofing materials 100 and 100. The space S is formed as described above, and therefore, even if rainwater comes into a gap between the two roofing materials 100, such rainwater can be drained outside through the space S. As a result, the water barrier property of the roof can be enhanced. Therefore, the space S serves as a drainage space between the roofing materials 100 overlapping
15 each other.

[0057]

In a case where the roofing material 100 includes the protrusion part 20, in order to enlarge the space S, it is sufficient that the roofing materials 100 are overlapped with each other such that the protrusions 20 of the respective roofing materials 100 are
20 displaced in a left and right direction so as not to face each other in the upward and downward direction. In other words, it is sufficient that the adjacent roofing materials 100 are connected to each other such that the protrusion part 20 formed on the upper roofing material 100b is placed on the flat part of the surface of the main body 1 of the lower roofing material 100a. Thereby, it is possible to more easily drain
25 rainwater which intrudes into a gap between the two roofing materials 100, and enhance the water barrier property of the roof more.

[0058]

The following detailed explanations referring to FIGS. 10A to 10D are made to the process of fixing the fixed piece 10 to a roof base 6 and the process of interconnecting
30 the adjacent roofing materials 100 and 100 in the inclining direction. First, the roofing material 100 (100A) is placed on the roof base 6 while the second fitting part 5 of the roofing material 100 (100A) is pulled upward in the inclining direction such that the roofing material 100 (100A) is not bent, and the fixed piece 10 is fixed by

driving a fixing member 11 such as a screw into the roof base 6 through the fixed piece 10. Next, a further roofing material 100 (100B) is placed so as to be adjacent to the fixed roofing material 100 (100A) in a lateral direction (direction perpendicular to the inclining direction). As mentioned above, the adjacent roofing materials 100A and 100B are overlapped and connected with each other so that the adjacent roofing materials 100A and 100B are displaced from each other in the lateral direction. Next, as shown in FIG. 10A, the fitting part 5 of the further roofing material 100B is put on the second fitting part 5 of the fixed roofing material 100A, and the fixed piece 10 of the further roofing material 100B is also put on the fixed piece 10 of the fixed roofing material 100A.

[0059]

As shown in FIG. 10B, next, the fixed piece 10 of the further roofing material 100B is fixed to the roof base 6 by driving the fixing member 11 into the roof base 6 through the fixed piece 10 of the further roofing material 100B and the fixed piece 10 of the fixed roofing material 100A.

[0060]

As described above, a plurality of roofing materials 100A, 100B, ... are installed sequentially so as to align in the lateral direction and thereafter another plurality of roofing materials 100C, 100D, ..., are installed sequentially on the upper sides of the plurality of roofing materials 100 so as to align in the lateral direction. At this time, as shown in FIG. 10C, the first fitting part 4 of the roofing material 100C on the upward side is inserted between the main body 1 and the second fitting part 5 of the roofing material 100 on the downward side (upper roofing material 100B). Thus, the inserted first fitting part 4 is caught on the bottom surface of the second fitting part 5. Thereafter, as shown in FIG. 10D, the first fitting part 4 of the further roofing material 100 (100D) on the upward side is inserted between the first fitting part 4 of the roofing material 100C on the upward side and the main body 1 of the roofing material 100B on the downward side. Thereby, the first fitting part 4 of the roofing material 100D on the upward side is caught on the second fitting part 5 of the roofing material 100B on the downward side. In this way, at the point where the four roofing materials 100 (100A, 100B, 100C, 100D) are adjacent in the vertical direction and in the lateral direction, finally the two first fitting parts 4 and the two second fitting parts 5 are overlapped. By installing the plurality of roofing materials 100

sequentially according to the above procedure, it is possible to from the roof.

CLAIMS

1. A roofing material to be connected to a further roofing material under a condition that respective sides of the roofing material and the further roofing material are

5 overlapped with each other,

the roofing material comprising:

a main body having a substantially flat plate shape; and

a fitting part formed at an end of the main body, and

10 the roofing material further comprising at least one positioning marker which is provided to the fitting part so as to indicate a position of an overlap between the respective sides.

2. The roofing material according to claim 1, wherein

15 the at least one positioning marker is formed by partially cutting out the fitting part.

3. The roofing material according to claim 1 or 2, wherein:

20 the roofing material comprises, as the at least one positioning marker provided to the fitting part, two positioning markers which are a first positioning marker and a second positioning marker; and

the first positioning marker and the second positioning marker are formed such that a distance of the first positioning marker from one of opposite side ends of the fitting part is substantially equal to a distance of the second positioning marker from the other of the opposite side ends of the fitting part.

25 4. A roof structure comprising two or more roofing materials according to any one of claims 1 to 3, adjacent two roofing materials of the two or more roofing materials being connected under a condition that respective sides of the adjacent two roofing materials are overlapped with each other so that one side end of the fitting part of one
30 of the adjacent two roofing materials conceals the at least one positioning marker of the other of the adjacent two roofing materials.